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(54) A coin segregator

(57) A coin segregator for segregating a mixed stream of coins (11, 12) into groups of different denominations comprises two substantially parallel coin receiving channels (1, 2) the bases of which (9) are inclined to the horizontal and the side walls (7) of which are upright but inclined to the vertical so that a coin (11, 12) introduced into the upper end of the first channel (1) rests against the side wall (7) of the first channel (1) and rolls along the base of the first channel towards its lower end, and a ramp surface (6) leading from the side wall (7) of the first channel (1) to the second channel (2) the ramp surface (6) having a lower edge arranged at a predetermined distance (h) from the base (9) of the first channel (1), the arrangement being such that, in use, a coin (11) having a diameter less than the predetermined distance (h) passes beneath the lower edge of the ramp surface (6), remains against the side wall of and continues to roll down the first channel (1) and a coin (12) having a diameter greater than the predetermined distance (h) engages the lower edge of the ramp surface (6) and is tilted and deflected into the second channel (2), the coin (12) remaining in a generally upright plane throughout its movement from the first (1) and into the second (2) channel.

Fig. 1.

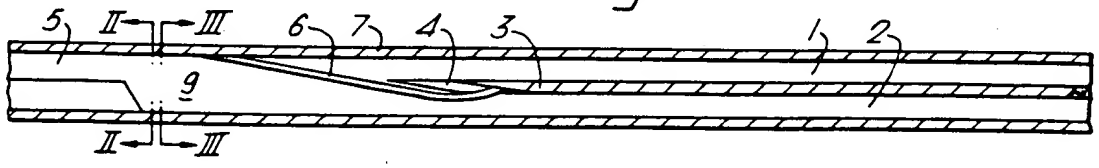
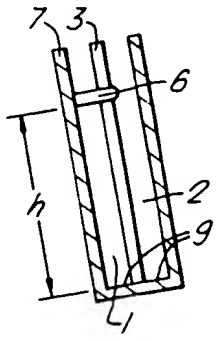


Fig. 3.



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SPECIFICATION

A coin segregator

This invention relates to a coin segregator for segrating a mixed stream of coins into groups of coins of different denominations. The present invention is of particular use when used in conjunction with, and downstream from an electronic coin validator. In such a coin validator the influence of a coin on an oscillating magnetic field is monitored to determine if the coin is valid and to determine the denomination of the coin. At present such coin validators often include a coin segregator downstream from the coin validation portion and in this type of coin segregator the coins are sorted into separate denominations by solenoid actuated gates to channel the coins of different denominations to different destinations. Such a system requires electrical power to operate the solenoid actuated gate and, in some instances where such coin validators are used the electrical power supply is limited. An example of this is when the coin validator forms part of a coin operated telephone. Another example is where the coin validation circuit is battery operated.

It has also been known for many years in coin freed mechanism which are entirely mechanical in operation to include a chute which is inclined to both the horizontal and the vertical so that a coin rests on the base of the chute and against the side wall as it rolls along the chute. The side wall of such a chute includes apertures of very precise dimensions. A coin of the correct denomination to free the mechanism will pass along the chute until it reaches a particular aperture whereupon it will tip and fall through that aperture. Coins or counterfeit slugs of different dimensions fall through different ones of the apertures. The apertures have to be very precisely made because they provide at least one of the tests which check to determine that the coin is valid before allowingl the mechanism to be freed by the coin. The coins tip through the apertures and so change from lying in a substantially upright plane and pass through a substantially horizontal plane as they tip through these apertures.

According to this invention a coin segregator for segregating a mixed stream of coins into groups of different denominations comprises two substantially parallel coin receiving channels the bases of which are inclined to the horizontal and the side walls of which are upright but inclined to the vertical so that a coin introduced into the upper end of the first channel rests against the side wall of the first channel and rolls along the base of the first channel towards its lower end, and a ramp surface leading from the side wall of the first channel to the second channel the ramp surface having a lower edge arranged at a predetermined distance from the base of the first channel, the arrangement being such that, in use, a coin having a diameter less than the predetermined distance passes beneath the lower edge of the ramp surface, remains against the side wall of and continues to roll down the first channel, and a coin having a diameter greater than the predetermined distance engages the lower edge of the ramp surface and is tilted and deflected into the second channel, the coin remaining in a generally upright plane throughout its movement from the first and into the second channel.

The coin sergregator in accordance with this invention is very simple and requires no electrical power whatsoever to ensure its operation. Because the coin segregator does not have to segregate slugs and counterfeit coins from valid coins the predetermined distance can be chosen so that there is plenty of clearance between the lower edge of the ramp surface and the base of the first channel to accomodate coins that are supposed to pass beneath the lower edge of the ramp surface whilst, at the same time, the coins that are to be deflected by the lower edge of the ramp surface merely engage the lower edge of the ramp surface and so are deflected by it. In general, the different coins of a coin set have their diameters relatively widely spaced and, for example, in the present United Kingdom coin set, each coin is at least two millimetres larger or smaller than any other coin in the set. When considering a 20p or 50p piece it is of course its rolling diameter that has to be considered. Thus, since there is a difference of at least two millimetres between any two coins the predetermined distance can be set so that there is about one millimetre clearance beneath the lower edge of the ramp surface and the largest coin that passes beneath the lower edge of the ramp surface whilst, at the same time, the smallest coin that is deflected by the ramp surface overlaps the lower edge of the ramp surface by at least one millimetre. Thus, with these degrees of tolerance the coin segregator can be made simply using basic machinery and also sufficient clearance can be provided to ensure that coins do not jam in passage through the segregator.

More than two channels may be provided and, in this case, the ramp surface extends between the side wall of the first channel and the last channel and a different predetermined distance exists between the lower edge of the ramp surface and the base of each channel. There may be as many channels as there are coins in any particular coin set or equally there may just be sufficient channels to accommodate coins acceptable to a particular machine with which the coin segregator is associated. It may however be sufficient for the coin segregator to have only two channels and to thus sort a mixed stream of coins into

15°. This is shown most clearly in Fig. 3. The inclination of the side wall 10 of the wedge-shaped portion is such that, when the coin segregator assembly is mounted in position the side wall 10 is also inclined to the vertical in the same sense as the side wall 7 but to a very much smaller extent, say 1 or 2°.

To use this type of coin segregator, coins are dropped into the wedge-shaped portion 5 and, because of the inclination of the side walls 10 and 7 the coins rest against the side wall 7 and roll along the base 9 of the channels towards the lower and downstream end of the coin segregator. Provided that the diameter of the coin is less than *h* the coin simply continues to lie against the side wall 7 and continues to roll down the channel 1. This is shown most clearly in Figs. 4 and 5 in which the coin having a diameter less than *h* is indicated by a reference numeral 11. When a coin having a larger diameter than the distance *h* is dropped into the wedge-shaped portion 5, it will, once again, initially come to rest against the side wall 7 and roll along the base 9 of the channels. This is the position shown in Figs. 6 and 7 with the coin having a larger diameter than *h* being indicated by reference numeral 12. As the coin 12 continues to roll downwards along the base 9 of the channels its upper end engages the bar 6 causing the coin 12 to tilt. This is shown most clearly in Figs. 8 and 9. Tilting of the coin 12 causes it to turn and move away from the side wall 7 and so causes its leading edge to pass out of channel 1 and into the channel 2 side of the feathered edge 4 of the central partition 3. This is shown most clearly in Figs. 10 and 11. Once the coin reaches this position it then just simply continues to roll down the channel 2 with it resting against the side wall of the central partition 3.

The bar 6 has to be located upstream of the feathered portion 4 of the partition 3 because the bar 6 engages the uppermost part of a coin 12 and this naturally lies behind the leading edge of the coin 12. It is preferred therefore that the bar 6 extends into the channel 2 a little beyond the side wall of the partition 3. In practice, the bar 6 will usually be formed integrally with the partition 3 and so have the form of a tongue extending upstream from the end partition 3.

The second example shows a coin segregator in accordance with this invention combined with a coin accepting device generally similar to that shown and described in our European Patent Application No 81301869.4 referred to above. The construction and operation of the coin accepting device is described in more detail in this European Patent Application. The coin accepting device includes a coin validation chamber 13 located beneath a coin entry slot (not shown) which is arranged to receive coins having a variety of different denominations. A pair of electrical coils 14 and 15 are located on opposite sides of the coin validation chamber 13 and form part of an electronic coin identification and validation apparatus which can identify the denomination of a particular coin and check to determine the validity of any coin. The base of the coin validation chamber 13 is inclined to the horizontal so that coins in the coin validation chamber are urged along the coin validation chamber, that is downwards as seen in Fig. 12 towards an outlet 16. A pivoted portion 17 provides a coin runway and includes the coin segregator in accordance with the present invention. This pivoted portion 17 includes a reject channel 18 and an acceptance channel 19 which is split into two separate acceptance channels 20 and 21 by a divider 22. A divider 23 separates the acceptance channel 19 from the reject channel 18.

Accept and reject solenoids 24 and 25 have the movable part of their armatures 26 and 27 connected to the pivoted portion 17. A projection 28 extending forwards from a fixed mounting block 29 fits between adjacent ends of the movable parts of the armatures 26 and 27 to provide the location of the pivoting portion 17. A tag 30 connected to the pivoted portion 17 includes a hole through which a coil torsion spring 31 is threaded and is arranged so that the pivoted portion 17 is urged against the fixed mounting block 29 and so biases the pivoted portion 17 into a central position in which the divider 23 blocks the outlet 16 of the coin validation chamber 13. However, upon actuation of the solenoids 24 and 25 respectively, the pivoted portion 17 can pivot in the clockwise direction or anti-clockwise direction as seen in Fig. 12 to align the acceptance channel 19 or the reject channel 18 with the outlet 16 of the coin validation chamber 13. A bar 31 is connected to the divider 23 and the divider 22 and leads from the channel 20 into the channel 21. This bar 21 is arranged at a fixed height from the base of the channels 20 and 21. Thus, the arrangement of the acceptance channels 19, 20 and 21 is substantially the same as the first example of coin segregator described above.

In operation, the pivoted portion 17 normally lays in its central position as shown in Fig. 12. In this position it blocks the outlet 16 of a coin validation chamber 13 so that any coins introduced into the coin validation chamber 13 are held in the fixed position whilst they are checked by the coils 14 and 15 for validity and denomination. If as a result of this check it is determined that the coin is not valid a coin then reject solenoid 25 is actuated to cause the pivoted portion 17 to pivot in the anti-clockwise direction so that the reject channel is aligned with the outlet 16 and so that the coin is discharged along the reject channel 18. If as a result of the test the coin present in the coin validation cham-

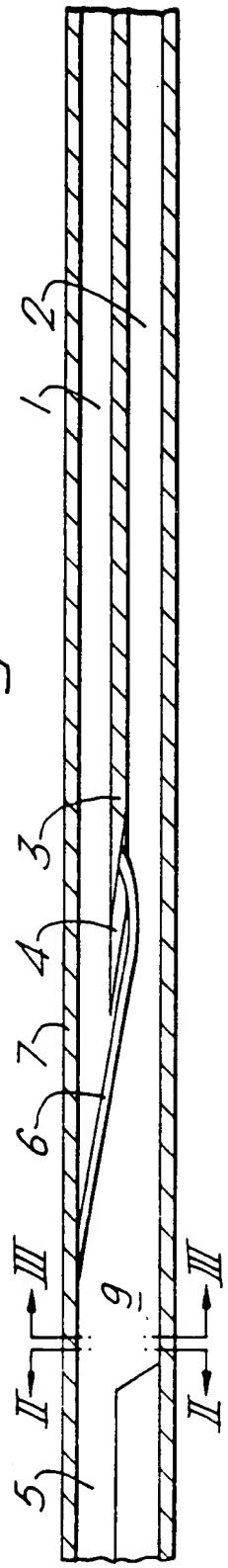

Fig. 1.

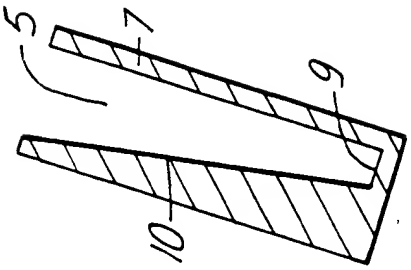

Fig. 2.

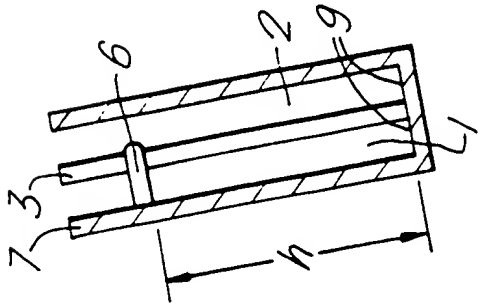

Fig. 3.

Fig. 5.

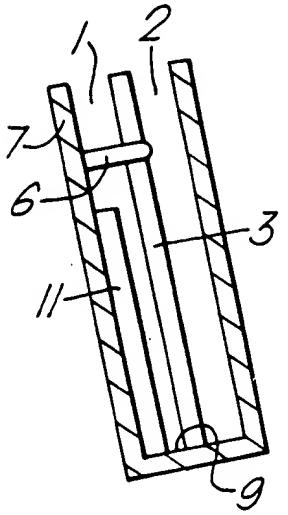

Fig. 7.

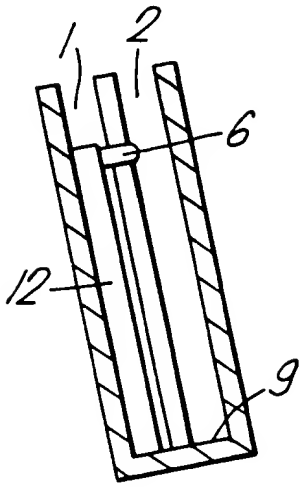

Fig. 9.

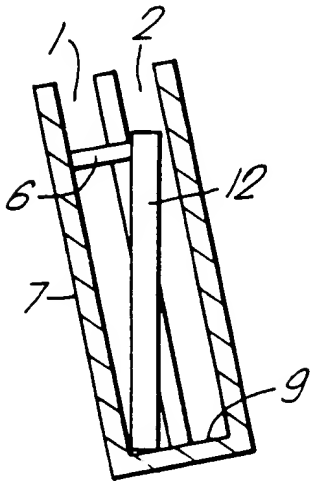

Fig. 11.